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NASA TECH BRIEF

NASA Pasadena Office

Long-Term Material Compatibility Testing System

The long-term compatibility of solid materials with fluids is often estimated from the results of short-term tests in which the materials are maintained in contact with fluids at elevated temperatures. However, when the performance of materials over prolonged periods of time (e.g., for a 10-year space mission) must be predicted with more accuracy than is permitted by data obtained from short-term tests. it is necessary to rely on the results of long-term tests conducted reliably, reproducibly, and under conditions closely resembling those encountered in actual use.

A system has been developed for determining the long-term compatibility of solid materials with fluids; it includes a procedure for hermetically sealing solid materials and fluids in a glass ampoule and use of a temperature-controlled facility containing a rotatable sample holder, which permits each of 2,000 sample containers to be retrieved safely and conveniently. Procedures have also been developed for packaging and shipping the samples in special containers after the test period; procedures for post-storage analysis of the materials and fluids are specified.

A given solid material and fluid to be evaluated are carefully prepared by standardized methods and then sealed within a chemically-clean glass ampoule according to a highly detailed procedure. Before being transported to the test facility, the ampoules are equipped with external strain gages to permit continuous monitoring of pressure developed in the containers during the test. Each ampoule is mounted in a niche on the outer surface of a sample holder (a cylinder which is rotatable on its vertical axis), and the strain gage of each ampoule is connected to on-line data-acquisition equipment. During test, the samples are maintained, typically, at 43.5 ±2.5°C.

Because many of the fluids within the ampoules are dangerous, the facility is designed to permit inspection or retrieval of each sample without hazard to personnel. Each niche can be moved to a position where the ampoule stored in it can be seen or removed through one of a number of individual, transparent, explosion-resistant doors.

The electrical output of each strain gage is recorded semi-automatically on conventional punched data cards as a stepping switch automatically connects the strain gage of each ampoule to the reading circuitry. The cards are collected at appropriate intervals and processed through a computer which prints out statistical data or plots of pressure vs. time. The documentation is such that the behavior of each sample can be traced throughout the test program.

At the termination of the test period, the ampoules may be shipped to an analytical laboratory in a specially-designed container which maintains the contents of the ampoules at −51°C for 72 hours. Procedures for the post-storage analysis are provided to the laboratory.

Note:

Requests for further information may be directed to:

Technology Utilization Officer
NASA Pasadena Office
4800 Oak Grove Drive
Pasadena, California 91103
Reference: TSP 73-10385

(continued overleaf)

Patent status:

NASA has decided not to apply for a patent.

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